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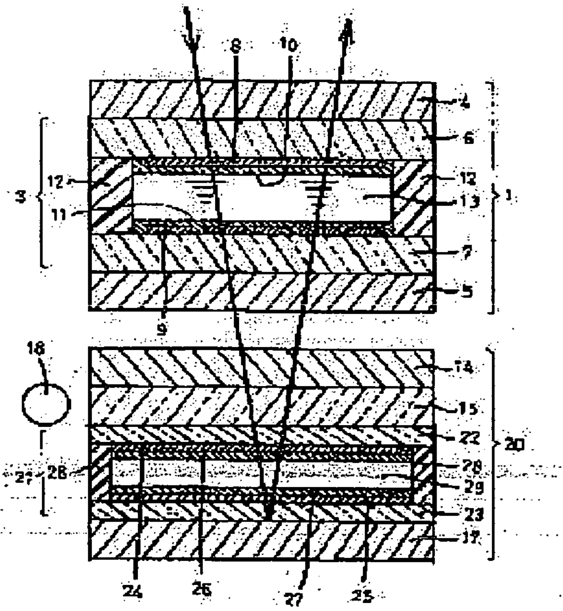
(54) BACK LIGHT DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a back light device high in the use efficiency of light not only when the device is used as a back light but when it is used as a reflector.

SOLUTION: A reflection polarizing plate 14 is disposed on the back face side of a liquid crystal display element 1, and a liquid crystal cell 21 for polarization conversion is disposed between a light guide member 15 and a reflecting plate 17 disposed in the back side of the reflection polarizing plate 14. The cell 21 can be switched according to application of voltage between the aligned state of liquid crystal molecules which generates phase difference corresponding to 1/4 wavelength in the transmitted light to change the polarizing state and the aligned state of the liquid crystal molecules which does not generate phase difference for the transmitted light. Therefore, the liquid crystal cell 21 for polarization conversion can be used as a 1/4λ plate or can be used as a light- transmitting member generating no phase difference.



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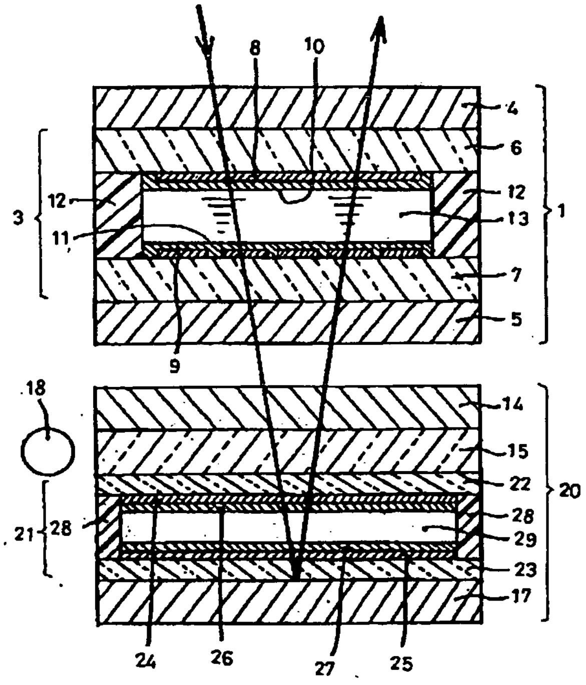
(54)【発明の名称】　バックライト装置

(57)【要約】
【課題】　バックライトとして使用する場合だけでなく、反射板として使用する場合も、共に光の利用効率が高いバックライト装置を提供する。
【解決手段】　液晶表示素子１の背面側に反射偏光板１４を配置し、この反射偏光板１４の背面側に配置される導光部材１５と反射板１７との間に、透過光に対しその（１／４）波長分の位相差を生じさせて偏光状態を変化させる液晶分子配向状態と透過光に対して位相差を生じさせない液晶分子配向状態とを電圧の印加に応じて切り換えることができる偏光変換用液晶セル２１を配置した。従って、偏光変換用液晶セル２１を（１／４）λ板として使用でき、また位相差の生じない透光部材としても使用できる。



【特許請求の範囲】

【請求項１】表示素子の背面側に設けられるバックライト装置であって、
前記表示素子の背面に対面して配置され一方の偏光成分の光を反射する反射軸と前記一方の偏光成分と直交する他方の偏光成分の光を透過する透過軸とを有する反射偏光板と、
この反射偏光板の前記表示素子とは反対の面側に配置された反射板と、
前記反射偏光板と前記反射板間に配設された導光部材と、
前記反射偏光板と前記反射板間に配設され、透過光に対しその（１＋２ｎ）／４（ただし、ｎは０を含む正の整数）波長分の位相差を生じさせて偏光状態を変化させる液晶分子配向状態と、透過光に対して位相差を生じさせない液晶分子配向状態とを電圧の印加に応じて切り換えられる偏光変換用液晶セルと、
前記導光部材の端面側に配置された光源とを有することを特徴とするバックライト装置。

【請求項２】前記偏光変換用液晶セルは、液晶分子がホモジニアス配向された液晶セルであることを特徴とする請求項１に記載のバックライト装置。

【請求項３】前記液晶セルは、屈折率異方性Δｎとセルギャップｄとの積Δｎ・ｄが１３８±２０ｎｍであることを特徴とする請求項２に記載のバックライト装置。

【請求項４】前記偏光変換用液晶セルは、液晶分子がツイスト配向された液晶セルであること特徴とする請求項１に記載のバックライト装置。

【請求項５】前記液晶セルは、ツイスト角が６３．７°で、屈折率異方性Δｎが０．０３でセルギャップｄが６５００ｎｍであることを特徴とする請求項４に記載のバックライト装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、光反射手段も兼ねる表示素子用バックライト装置に関し、特に液晶表示素子に好適なバックライト装置に関する。

【０００２】

【従来の技術】従来、液晶表示装置においては、図５に示すように、液晶表示素子１の背面側をバックライト装置２で照明することにより、液晶表示素子１に表示された画像などの情報が暗い所でも視認できるようになっている。このような液晶表示装置の液晶表示素子１は、表示用の液晶セル３を備え、この液晶セル３の上面に上偏光板４が設けられ、液晶セル３の下面に下偏光板５が設けられた構造になっている。この表示用の液晶セル３は、上下一対の透明な基板６、７の対向面にそれぞれＩＴＯなどからなる透明な電極８、９が例えば単純マトリクス型の場合は行および列方向に夫々複数条づつ設けられていると共に、これら電極８、９を覆って配向膜１０、１１が設けられ、これら配向膜１０、１１を上下に対向させた状態で一対の基板６、７が枠状のシール材１２を介して接合され、このシール材１２および一対の基板６、７で囲われた領域内に液晶１３が封入された構造になっている。

【０００３】この場合、液晶セル３の上下に対向する配向膜１０、１１は、所謂ＴＮ型液晶表示素子の場合、図６に示すように、互いにほぼ直交する方向に配向処理が施されている。すなわち、図６において、矢印Ａは下側基板７の配向膜１１に接近する液晶分子の配向方向（つまり配向膜１１の配向処理方向と同じ方向）を示し、矢印Ｂは上側基板６の配向膜１０に接近する液晶分子の配向方向（つまり配向膜１０の配向処理方向と同じ方向）を示している。これにより、液晶１３の分子は、上下一対の基板６、７間において、液晶表示素子１を上面側から見て時計回りにほぼ９０°のツイスト角でツイスト配向されている。また、上偏光板４は、その透過軸４ａが液晶セル３の上側基板６の配向処理方向Ｂとほぼ直交した状態で配置されており、下偏光板５は、その透過軸５ａが液晶セル３の下側基板７の配向処理方向Ａとほぼ直交した状態で配置されている。

【０００４】このような液晶表示素子１の背面側を照明するバックライト装置２は、図５に示すように、液晶表示素子１の背面つまり下偏光板５の下面に対面する反射偏光板１４と、この反射偏光板１４の下面に対面する導光部材１５と、この導光部材１５の下面に対面する位相差板１６と、この位相差板１６の下面に対面する反射板１７とが上から順に積層され、かつ導光部材１５の一方の端面側に光源１８が配置された構造になっている。この場合、反射偏光板１４は、図６に示すように、互いに直交する一方の偏光成分の光を反射する反射軸１４ａとその一方の偏光成分と直交する他方の偏光成分の光を透過する透過軸１４ｂとを有し、反射軸１４ａが液晶セル３の下偏光板５の透過軸５ａとほぼ直交し、透過軸１４ｂが下偏光板５の透過軸５ａとほぼ平行となるように配置されている。また、位相差板１６は、（１／４）λ（波長）板であり、その遅相軸１６ａが反射偏光板１４の反射軸１４ａと透過軸１４ｂとに対してほぼ４５°で交差するように設けられている。

【０００５】このようなバックライト装置２で液晶表示素子１を背面側から照明する場合には、図７に示すように、光源１８を点灯させると、光源１８からの光が導光部材１５に導入され、この導入された光が導光部材１５から反射偏光板１４を介して液晶表示素子１の下偏光板５に向けて出射される。このときには、反射偏光板１４の透過軸１４ｂに沿った振動面を持つ偏光成分の光（以下、偏光成分光という）が透過して下偏光板５に向けて出射されるほか、反射軸１４ａに沿った偏光成分光は位相差板１６に向けて反射される。この反射された光は、位相差板１６を透過するときに（１／４）λ位相がずれ、

この位相がずれた光が反射板１７で反射されて再び位相差板１６を透過するので、更に(１／４)λ位相がずれる。このため、反射偏光板１４で反射された光は(１／４)λ位相差板１６を２回透過することにより、(１／２)λ位相がずれて反射軸方向の偏光成分光が透過軸方向の偏光成分光となり、これにより反射偏光板１４を透過して液晶表示素子１の下偏光板５に向けて出射される。このように、このバックライト装置２によれば、光源１８から導光部材１５に導入された光を無駄を抑え効率良く利用して液晶表示素子１を照明することができる。

【０００６】また、液晶表示素子１を反射型として使用する場合には、図８に示すように、光源１８を消灯させた状態で、液晶表示素子１の上面側から外部光を取り込む。このときには、外部光の上偏光板４の透過軸４ａに沿った偏光成分光が取り込まれて表示用の液晶セル３を透過した後、下偏光板５の透過軸５ａに沿った偏光成分光が下偏光板５を透過してバックライト装置２の反射偏光板１４に入射する。この反射偏光板１４に入射した光は、反射偏光板１４の透過軸１４が下偏光板５の透過軸５ａとほぼ平行であるから、図８に示すように、反射偏光板１４を透過し、この後、導光部材１５を透過して位相差板１６に入射する。

【０００７】このように位相差板１６に入射した光は、これを透過するときに(１／４)λ位相がずれ、この位相のずれた光が反射板１７で反射されて再び位相差板１６を透過する際にさらに(１／４)λ位相がずれるので、この透過した光は１／２λ位相がずれて反射偏光板１４の反射軸１４ａに沿った偏光成分光となる。このため、位相差板１６を１往復した光は、反射偏光板１４の反射軸１４ａで再び反射されることになり、この反射された光が上記と同じ動作を繰り返して位相差板１６を再度１往復して透過し、更に(１／２)λ位相がずれて反射偏光板１４の透過軸１４ｂに沿った偏光成分光となる。このように、下偏光板５を透過して反射偏光板１４に入射した光は、位相差板１６を２往復した後に、反射偏光板１４を透過して、再び液晶表示素子１の下偏光板５に入射する。

【０００８】これにより、このバックライト装置２は、反射板として機能し、液晶表示素子１の上面側から入射して下面側から出射した光を反射させることにより、液晶表示素子１の下面側に再度入射させることができる。このように、このバックライト装置２では、光源１８を点灯させることにより液晶表示素子１の背面側を照明することができ、また光源１８を消灯させた場合には液晶表示素子１を反射型の液晶表示素子として表示させるための反射板としての機能も持っている。

【０００９】

【発明が解決しようとする課題】しかしながら、このようなバックライト装置２では、反射板として使用する場合、上述したように液晶表示素子１を透過して入射した光をバックライト装置２内で２往復させなければ、再度液晶表示素子１側へ入射させることができない。このため、このバックライト装置２では、液晶表示素子１の透過光を単に反射板で反射させる場合に比べて、光の損失が多く、反射型モードで表示をする場合に液晶表示素子１の表示が暗くなるという問題がある。

【００１０】この発明の課題は、本来のバックライトとして使用する場合だけでなく、反射板として使用する場合も、共に光の利用効率が高いバックライト装置を提供することである。

【００１１】

【課題を解決するための手段】この発明は、表示素子の背面側に設けられるバックライト装置であって、前記表示素子の背面に対面して配置され一方の偏光成分の光を反射する反射軸と前記一方の偏光成分と直交する他方の偏光成分の光を透過する透過軸とを有する反射偏光板と、この反射偏光板の前記表示素子とは反対の面側に配置された反射板と、前記反射偏光板と前記反射板間に配設された導光部材と、前記反射偏光板と前記反射板間に配設され、透過光に対しその（１＋２ｎ）／４（ただし、ｎは０を含む正の整数）波長分の位相差を生じさせて偏光状態を変化させる液晶分子配向状態と、透過光に対して位相差を生じさせない液晶分子配向状態とを電圧の印加に応じて切り換えられる偏光変換用液晶セルと、前記導光部材の端面側に配置された光源とを有することを特徴とする。

【００１２】この発明によれば、偏光変換用液晶セルに印加される電圧（電界）の電圧の印加に応じて、偏光変換用液晶セルを(１／４)λ位相差板の作用と位相差が変化しない透光部材の作用とに切り換えることができる。このため、偏光変換用液晶セルを(１／４)λ位相差板として機能させることにより、光源からの光を導光部材に導入して効率良く表示素子の背面側へ入射させることができる。また、偏光変換用液晶セルを位相差が生じさせない透光部材として機能させることにより、表示素子を透過して背面側に出射した光が偏光変換用液晶セルに入射して透過するときに、位相差を生じることなく透過して反射板で反射されるので、偏光変換用液晶セルを１往復するだけで反射偏光板を透過させて表示素子の背面側に入射させることができる。これにより、このバックライト装置は、表示素子の反射板として高い反射率の反射機能を有し、液晶表示素子に使用して、従来例に比べて、光の損失が少なく、光の利用効率を高めることができる。

【００１３】この場合、請求項２に記載のごとく、前記偏光変換用液晶セルは、液晶分子がホモジニアス配向された液晶セルであることにより、電界を印加しないときに液晶分子がホモジニアス配向することにより、(１／４)λ位相差板として使用し、また電圧を印加したとき

に液晶分子が偏光変換用液晶セルの一対の基板に対してほぼ垂直に配向することにより、位相差が生じない透光部材として使用することができる。この場合には、請求項３に記載のごとく、前記液晶セルは、屈折率異方性Δｎとセルギャップｄとの積Δｎ・ｄが１３８±２０ｎｍであることが望ましい。

【００１４】また、請求項４に記載のごとく、前記偏光変換用液晶セルは、液晶分子がツイスト配向された液晶セルであることにより、電界を印加しないときに液晶分子がツイスト配向することにより、位相差が変化する位相差板として使用し、また電界を印加したときに液晶分子が偏光変換用液晶セルの一対の基板に対してほぼ垂直に配向することにより、位相差が生じない透光部材として使用することができる。この場合には、請求項５に記載のごとく、前記液晶セルは、ツイスト角が６３．７°で、屈折率異方性Δｎが０．０３でセルギャップｄが６５００ｎｍであることが望ましい。

【００１５】

【発明の実施の形態】以下、図１～図４を参照して、この発明のバックライト装置の一実施形態について説明する。なお、図５～図８に示された従来例と同一の構成要素には同一符号を付して説明する。このバックライト装置２０は、従来例の(１／４)λ位相差板１６に代えて、偏光変換用液晶セル２１を導光部材１５と反射板１７との間に設けた構造となっている。

【００１６】この偏光変換用液晶セル２１は、図１に示すように、上下一対の透明な基板２２、２３の対向面全域にＩＴＯなどからなる透明な１枚平面状の電極２４、２５が設けられていると共に、これら電極２４、２５を覆って配向膜２６、２７が設けられ、これら配向膜２６、２７を上下に対向させた状態で一対の基板２２、２３が枠状のシール材２８を介して接合され、このシール材２８および一対の基板２２、２３で囲われた領域内に液晶２９が封入され、かつこの液晶２９の分子がホモジニアス配向された構造になっている。

【００１７】すなわち、この偏光変換用液晶セル２１は、ツイスト角が０°で、液晶２９の屈折率異方性Δｎが０．０２１で、セルギャップつまり液晶層厚ｄが６５００ｎｍで、屈折率異方性Δｎと液晶層厚ｄとの積Δｎ・ｄが１３８±２０ｎｍに設定され、図２に示すように、液晶分子が反射偏光板１４の反射軸１４ａと透過軸１４ｂとに対してほぼ４５°で交差する方向２９ａに初期配向するように、配向膜２６、２７に配向処理がなされている。これにより、この偏光変換用液晶セル２１は、電極２４、２５に電圧が印加されないときに、液晶分子がホモジニアス配向することにより、(１／４)λ板と同じ機能を有し、また電圧が印加されたときに、液晶分子が基板２２、２３に対しほぼ垂直方向に配向されることにより、液晶層の屈折率異方性がほぼ無くなり、つまりΔｎ≒０となり、透過光に位相差を殆ど生じさせないように構成されている。

【００１８】このように、偏光変換用液晶セル２１は、電圧が印加されないときに、液晶分子がホモジニアス配向して(１／４)λ位相差板と同じ機能を有し、かつ電圧が印加されたときには、液晶分子が基板２２、２３に対しほぼ垂直方向に配向して位相差が生じないから、この偏光変換用液晶セル２１は、電圧の非印加／印加に応じて、(１／４)λの位相差板の機能と、位相差の生じない透光板の機能とが切り換えられる。

【００１９】このため、このバックライト装置２０では、光源１８を点灯して、面光源として使用するときは、偏光変換用液晶セル２１に電圧を印加せずに、偏光変換用液晶セル２１を(１／４)λ板として機能させる。すなわち、図３に示すように、光源１８を点灯させると、その光が導光部材１５に導入され、この導入された光のうち、反射偏光板１４の透過軸１４ｂに沿った偏光成分光が、反射偏光板１４を透過して液晶表示素子１の背面に向けて下偏光板５の透過軸５ａに沿った偏光成分光として出射されるほか、反射軸１４ａに沿った偏光成分光が偏光変換用液晶セル２１に向けて反射される。この反射された偏光成分光は、偏光変換用液晶セル２１を透過するときに(１／４)λ位相がずれ、この位相がずれた光が反射板１７で反射されて再び偏光変換用液晶セル２１を透過して更に(１／４)λ位相がずれるため、反射偏光板１４の透過軸１４ｂに沿った偏光成分光となり、反射偏光板１４を透過して液晶表示素子１の背面に向けて下偏光板５の透過軸５ａに沿った光として出射される。このため、このバックライト装置２０では、従来例と同様、導光部材に導入された光をロスを抑えて効率良く液晶表示素子１の背面側に入射させることができる。

【００２０】また、バックライトを反射板として用いるときは、偏光変換用液晶セル２１に電圧を印加して偏光変換用液晶セル２１を位相差の生じない透光板として使用する。即ち、図４に示すように、光源１８を消灯させた状態で、液晶表示素子１の上面側から外部光を取り込む。このときには、従来例と同様、外部光の内の上偏光板４の透過軸４ａに沿った偏光成分光が取り込まれて表示用の液晶セル３を透過するが、このときに偏光面が９０°回転(旋光)して下偏光板５の透過軸５ａに沿った偏光成分光となって下偏光板５を透過し、バックライト装置２０の反射偏光板１４に入射する。この反射偏光板１４に入射した偏光成分光は、反射偏光板１４の透過軸１４ｂが下偏光板５の透過軸５ａとほぼ平行であるから、図４に示すように、反射偏光板１４および導光部材１５を透過して偏光変換用液晶セル２１に入射する。

【００２１】このとき、偏光変換用液晶セル２１は電圧が印加されて液晶分子が基板に垂直な方向に配向した状態となっているから、偏光変換用液晶セル２１に入射した光は、位相差が生じることなく偏光変換用液晶セル２１を透過して反射板１７で反射され、この反射された光

が再び位相差が生じることなく偏光変換用液晶セル２１を透過するので、偏光変換用液晶セル２１を１往復するだけで反射偏光板１４の透過軸１４ｂに沿った偏光成分光のまま、反射偏光板１４を透過して液晶表示素子１背面側の下偏光板５に入射し、この偏光成分光は透過軸５ａに沿った偏光成分光であるから下偏光板５を透過する。このように、本発明に係るバックライト装置２０は、液晶表示素子１の反射板として使用しても、従来例のように内部で光を２往復させないから、光の損失が少なく、光の利用効率を高めることができ、これにより液晶表示素子１の反射モード時の表示を明るくすることができる。

【００２２】なお、上記実施形態では、偏光変換用液晶セルとして、ツイスト角が０°で、液晶２９の屈折率異方性Δｎが０．０２１で、セルギャップｄが６５００ｎｍで、屈折率異方性Δｎとセルギャップｄとの積Δｎ・ｄが１３８±２０ｎｍである偏光変換用液晶セル２１を用いた場合について述べたが、これに限らず、例えば、ツイスト角が０°で、液晶の屈折率異方性Δｎが０．０６３で、セルギャップｄが６５００ｎｍで、屈折率異方性Δｎとセルギャップｄとの積Δｎ・ｄが４１４±２０ｎｍである偏光変換用液晶セルを用いても良い。即ち、偏光変換用液晶セルは、そのΔｎｄの値が（１＋２ｎ）λ／４（ただし、ｎは0を含む正の整数：０，１，２）である。

【００２３】また、上記実施形態では、偏光変換用液晶セルとして、液晶分子をホモジニアス配向させた偏光変換用液晶セル２１を用いた場合について述べたが、これに限らず、例えば液晶分子をツイスト配向させた偏光変換用液晶セルを用いても良い。この場合にも、偏光変換用液晶セルは、電圧を印加しないときに、液晶分子がツイスト配向することにより、（１／４）λ位相差板と同じ機能を有し、また電圧が印加されたときに、液晶分子が一対の基板２２、２３に対してほぼ垂直方向に配向することにより、液晶層の屈折率異方性がほぼ無くなり、つまりΔｎ≒０となり、透過光に位相差を殆ど生じさせないように構成されていれば良い。

【００２４】このような偏光変換用液晶セルとしては、ツイスト角が６３．７°で、屈折率異方性Δｎが０．０３で、セルギャップｄが６５００ｎｍで、屈折率異方性Δｎとセルギャップｄとの積Δｎ・ｄが０．０３×６５００＝１９５ｎｍの液晶セルが好ましいが、これに限らず、ツイスト角が１９０．１°で、屈折率異方性Δｎが０．０９で、セルギャップｄが６５００ｎｍで、屈折率異方性Δｎとセルギャップｄとの積Δｎ・ｄが０．０９×6500＝５８５ｎｍの液晶セル、またはツイスト角が３１８．２°で、屈折率異方性Δｎが０．１５で、セルギャップｄが６５００ｎｍで、屈折率異方性Δｎとセルギャップｄとの積Δｎ・ｄが０．１５×6500＝９７５ｎｍの液晶セルであっても良い。

【００２５】なお、本発明のバックライト装置は、液晶表示素子用のバックライト装置に限らず、入射光として所定の偏光成分光を必要とする各種の表示素子用のバックライト装置として広く適用することができる。また、上記実施形態では偏光変換用液晶セルが導光部材と反射板の間に配置されているが、これに限らず、偏光変換用液晶セルは導光部材と反射偏光板の間に配置してもよく、その場合にも上記実施形態の場合と同様の効果が奏される。

【００２６】

【発明の効果】以上説明したように、この発明においては、表示素子の背面側に反射偏光板を配置し、この反射偏光板の背面側に配置される反射板との間に、導光部材と印加される電圧に応じて透過光の偏光状態を変化させる偏光変換用液晶セルを配置し、偏光変換用液晶セルを（１／４）λ位相差板として使用することができると共に、位相差が変化しない透光部材としても使用することができる構成とした。これにより、本発明のバックライト装置を透過型表示素子のバックライトとして使用する場合は、偏光変換用液晶セルを（１／４）λ位相差板として使用し、従来例と同様、光源からの光を有効に利用して効率良く表示素子の背面側を照明することができる。また、本発明のバックライト装置を反射型表示素子の反射板として使用する場合は、偏光変換用液晶セル２１を偏光変換用液晶セルを位相差の生じない透光部材として使用し、反射偏光板を透過して偏光変換用液晶セルに入射した光を位相差を生じさせることなく偏光変換用液晶セルを透過させて反射板で反射させ、偏光変換用液晶セルを１往復するだけで反射偏光板を透過させて表示素子の背面側に入射させることができる。これにより、表示素子の光反射手段として使用しても、従来例に比べて、光の損失が少なく、光の利用効率を高めることができる。

【００２７】この場合、偏光変換用液晶セルは、液晶分子がホモジニアス配向された液晶セルであることにより、電界を印加しないときに液晶分子がホモジニアス配向することにより、（１／４）λ位相差板として使用し、また電界を印加したときに液晶分子が偏光変換用液晶セルの一対の基板に対してほぼ垂直方向に配向することにより、位相差が生じない透光部材として使用することができる。また、偏光変換用液晶セルは、液晶分子がツイスト配向された液晶セルであることにより、電界を印加しないときに液晶分子がツイスト配向することにより、（１／４）λ位相差板として使用し、また電界を印加したときに液晶分子が偏光変換用液晶セルの一対の基板に対してほぼ垂直方向に配向することにより、位相差が生じない透光部材として使用することができる。

【図面の簡単な説明】

【図１】この発明のバックライト装置を液晶表示素子の下面側に配置した一実施形態を示した断面図。

【図２】図１の各部材の光学軸を示した図。

【図３】図１のバックライト装置で液晶表示素子を照明するときの光の進行状態を示した図。

【図４】図１のバックライト装置を反射板として使用するときの光の進行状態を示した図。

【図５】従来のバックライト装置を液晶表示素子の下面側に配置した状態を示した断面図。

【図６】図５の各部材の光学軸を示した図。

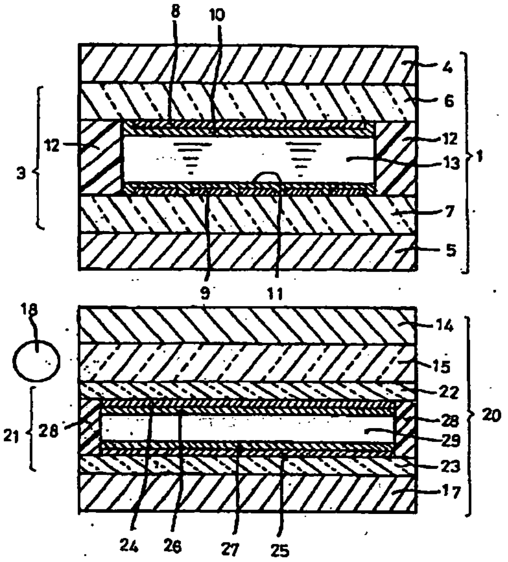
【図７】図５のバックライト装置で液晶表示素子を照明するときの光の進行状態を示した図。

【図８】図５のバックライト装置を反射板として使用するときの光の進行状態を示した図。

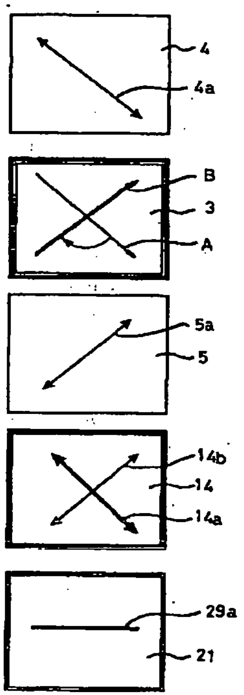
【符号の説明】

１	液晶表示素子
３	表示用の液晶セル
４	上偏光板
５	下偏光板
１４	反射偏光板
１４ａ	反射軸
１４ｂ	透過軸
１５	導光部材
１７	反射板
１８	光源
２０	バックライト装置
２１	偏光変換用液晶セル

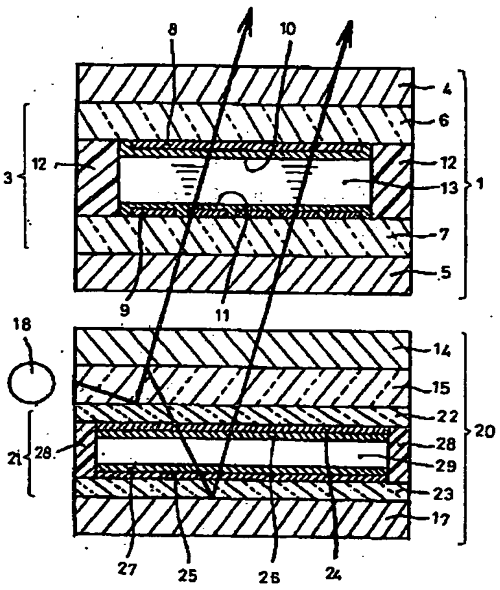
【図１】



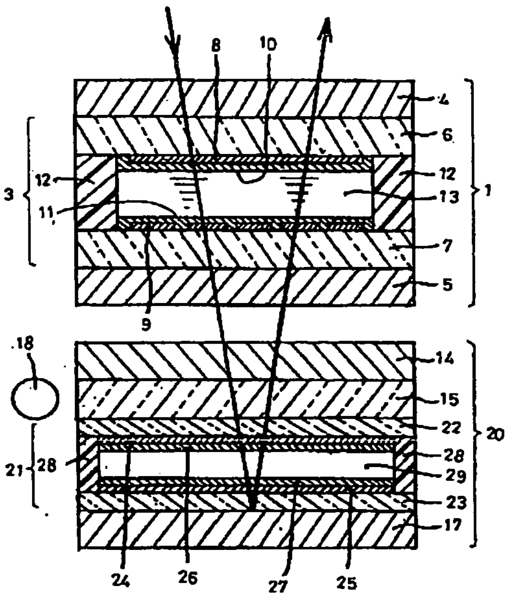
【図２】



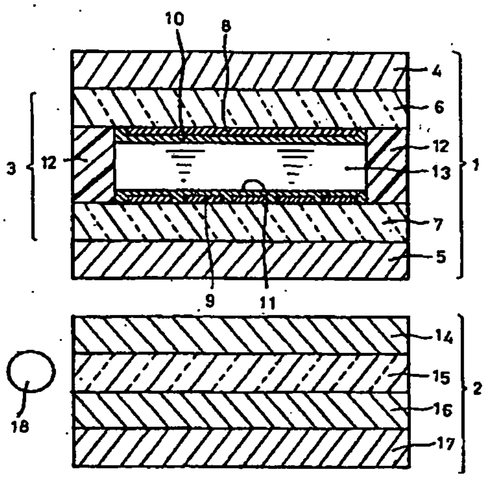
【図３】



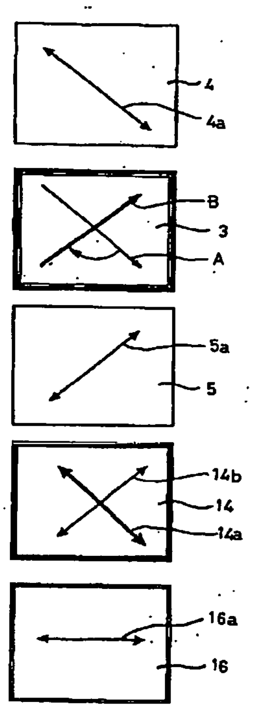
【図4】



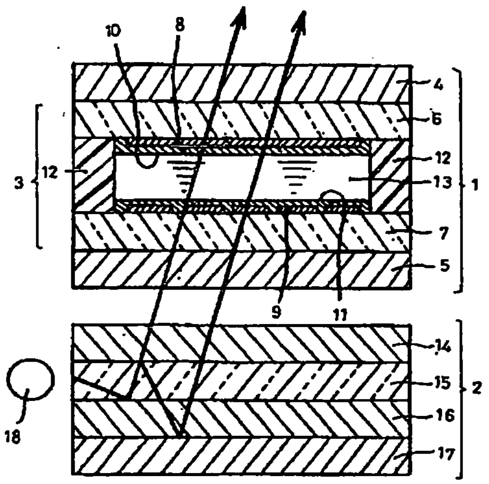
【図5】



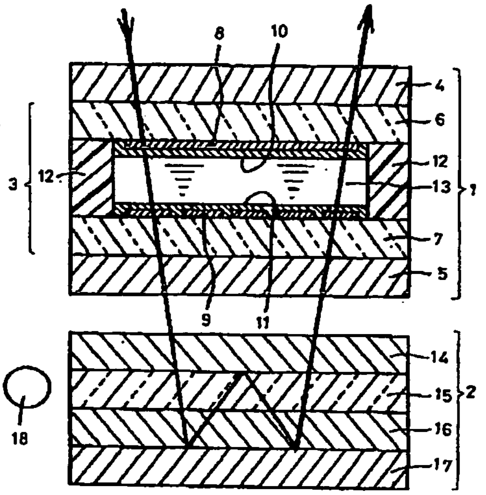
【図6】



【図7】



【図8】



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[Claim(s)]

[Claim 1] The reflective polarizing plate which has the transparency shaft which penetrates the light of the polarization component of another side which intersects perpendicularly with the reflective shaft which is back light equipment formed in the tooth-back side of a display device, and the tooth back of said display device is met, and while is arranged, and reflects the light of a polarization component, and one [said] polarization component, The reflecting plate arranged at the field side opposite to said display device of this reflective polarizing plate, It is arranged between the light guide section material arranged between said reflective polarizing plates and said reflecting plates, and said reflective polarizing plate and said reflecting plate. The liquid crystal molecular orientation condition of making the transmitted light producing the phase contrast for (1+2n) / 4 (however, positive integer in which n contains 0) wavelength of opposite Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne., and changing a polarization condition, Back light equipment characterized by having the liquid crystal cell for polarization conversion switched according to impression of an electrical potential difference in the liquid crystal molecular orientation condition of not producing phase contrast to the transmitted light, and the light source arranged at the end-face side of said light guide section material.

[Claim 2] Said liquid crystal cell for polarization conversion is back light equipment according to claim 1 characterized by a liquid crystal molecule being the liquid crystal cell by which homogeneous orientation was carried out.

[Claim 3] Said liquid crystal cell is back light equipment according to claim 2 characterized by product deltan-d of refractive-index anisotropy deltan and the cel gap d being 138**20nm.

[Claim 4] Said liquid crystal cell for polarization conversion is back light equipment according to claim 1 by which it is being [a liquid crystal molecule / the liquid crystal cell by which twist orientation was carried out] characterized.

[Claim 5] For said liquid crystal cell, the cel gap d is back light equipment according to claim 4 with which a twist angle is 63.7 degrees and refractive-index anisotropy deltan is characterized by being 6500nm by 0.03.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the suitable back light equipment especially for a liquid crystal display component about the back light equipment for display devices which serves also as a light reflex means.

[0002]

[Description of the Prior Art] Conventionally, as a liquid crystal display is shown in drawing 5 , the information on the image displayed on the liquid crystal display component 1 can check by looking now even in a dark place by illuminating the tooth-back side of the liquid crystal display component 1 with back light equipment 2. Such a liquid crystal display component 1 of a liquid crystal display has the structure where had the liquid crystal cell 3 for a display, the upper polarizing plate 4 was formed in the top face of this liquid crystal cell 3, and the bottom polarizing plate 5 was formed in the inferior surface of tongue of a liquid crystal cell 3. When the transparent electrodes 8 and 9 which become the opposed face of the transparent substrates 6 and 7 of a vertical pair from ITO etc., respectively are for example, passive-matrix molds, while the two or more articles liquid crystal cell 3 for this display is formed at a time in the line and the direction of a train, respectively Cover these electrodes 8 and 9, the orientation film 10 and 11 is formed, and the substrates 6 and 7 of a pair are joined through the frame-like sealant 12 in the condition of having made these orientation film 10 and 11 countering up and down. It has the structure where liquid crystal 13 was enclosed in the field enclosed with this sealant 12 and the substrates 6 and 7 of a pair.

[0003] In this case, as the orientation film 10 and 11 with which a liquid crystal cell 3 counters up and down is shown in drawing 6 R> 6 in the case of the so-called TN liquid crystal display device, orientation processing is performed in the direction which intersects perpendicularly mostly mutually. That is, in drawing 6 , an arrow head A shows the direction of orientation of the liquid crystal molecule close to the orientation film 11 of the bottom substrate 7 (that is, the same direction as the orientation processing direction of the orientation film 11), and the arrow head B shows the direction of orientation of the liquid crystal molecule close to the orientation film 10 of the top substrate 6 (that is, the same direction as the orientation processing direction of the orientation film 10). Thereby, between the substrate 6 of a vertical pair, and 7, the molecule of liquid crystal 13 looks at the liquid crystal display component 1 from a top-face side, and twist orientation is clockwise carried out on about 90-degree twist square. Moreover, the upper polarizing plate 4 is arranged after the orientation processing direction B of the top substrate 6 of a liquid crystal cell 3 and the transparency shaft 4a have crossed at right angles mostly, and the bottom polarizing plate 5 is arranged after the orientation processing direction A of the bottom substrate 7 of a liquid crystal cell 3 and the transparency shaft 5a have crossed at right angles mostly.

[0004] The back light equipment 2 which illuminates the tooth-back side of such a liquid crystal display component 1 The reflective polarizing plate 14 which meets the tooth back of the liquid crystal display component 1, i.e., the inferior surface of tongue of the bottom polarizing plate 5, as shown in drawing 5 , It has the structure where the laminating of the light guide section material 15 which meets the inferior surface of tongue of this reflective polarizing plate 14, the phase contrast plate 16 which meets the inferior surface of tongue of this light guide section material 15, and the reflecting plate 17 which meets the inferior surface of tongue of this phase contrast plate 16 was carried out to order from the top, and the light source 18 has been arranged at one end-face side of the light guide section material 15. In this case, as the reflective polarizing plate 14 is shown in drawing 6 , it has transparency shaft 14b which penetrates the light of the polarization component of another side which while intersects perpendicularly mutually and intersects perpendicularly with reflective shaft 14a which reflects the light of a polarization component, and the polarization component of one of these. Transparency shaft 5a of the bottom polarizing plate 5 of a liquid crystal cell 3 and reflective shaft 14a cross at right angles mostly, and it is arranged so that transparency shaft 14b may become almost parallel to transparency shaft 5a of the bottom polarizing plate 5. Moreover, the phase contrast plate 16 is a lambda (1/4) (wavelength) plate, and it is formed so that the lagging-axis 16a may cross at about 45 degrees to reflective shaft 14a of the reflective polarizing plate 14, and transparency shaft 14b.

[0005] If the light source 18 is made to turn on as shown in drawing 7 when illuminating the liquid crystal display component 1 from a tooth-back side with such back light equipment 2, the light from the light source 18 will be introduced into the light guide section material 15, and outgoing radiation of this introduced light will be carried out towards the bottom polarizing plate 5 of the liquid crystal display component 1 through the reflective polarizing plate 14 from the light guide section material 15. At this time, the light (henceforth polarization component light) of a polarization component with the plane of vibration in alignment with transparency shaft 14b of the reflective polarizing plate 14 penetrates, and outgoing radiation is carried out towards the bottom polarizing plate 5, and also the polarization component light in alignment with reflective shaft 14a is reflected towards the phase contrast plate 16. Since the light from which lambda (1/4) phase shifted, and this phase shifted is reflected with a reflecting plate 17 and this reflected light penetrates the phase contrast plate 16 again when penetrating the phase contrast plate 16, lambda phase shifts further (1/4). For this reason, by penetrating lambda (1/4) phase contrast plate 16 twice, lambda (1/2) phase shifts, the polarization component light of reflective shaft orientations turns into polarization component light of transparency shaft orientations, the light reflected with the reflective polarizing plate 14 penetrates the reflective polarizing plate 14 by this, and outgoing radiation is carried out towards the bottom polarizing plate 5 of the liquid crystal display component 1. Thus, according to this back light equipment 2, futility can be stopped, the light introduced into the light guide section material 15 from the light source 18 can be used efficiently, and the liquid crystal display component 1 can be illuminated.

[0006] Moreover, in using the liquid crystal display component 1 as a reflective mold, as shown in drawing 8 , it incorporates an extraneous light from the top-face side of the liquid crystal display component 1 in the condition of having made the light source 18 switching off. After incorporating the polarization component light in alignment with transparency shaft 4a of the upper polarizing plate 4 of an extraneous light at this time and penetrating the liquid crystal cell 3 for a display, the polarization component light in alignment with transparency shaft 5a of the bottom polarizing plate 5 penetrates the bottom polarizing plate 5, and carries out incidence to the reflective polarizing plate 14 of back light equipment 2. Since the light which carried out incidence to this reflective polarizing plate 14 has the transparency shaft 14 of the reflective polarizing plate 14 almost parallel to transparency shaft 5a of the bottom polarizing plate 5, as shown in drawing 8 , it penetrates the reflective polarizing plate 14, penetrates the light guide section material 15 after this, and it carries out incidence to the phase contrast plate 16.

[0007] Thus, since lambda phase shifts further (1/4) in case it is reflected with a reflecting plate 17 and the light from which lambda (1/4) phase shifted, and this phase shifted penetrates the phase contrast plate 16 again, when penetrating this, the light which carried out incidence to the phase contrast plate 16 This transmitted light turns into polarization component light which 1 / 2lambda phase shifted and met reflective shaft 14a of the reflective polarizing plate 14. For this reason, this reflected light goes and comes back to the phase contrast plate 16 one again, and it will be again reflected by reflective shaft 14a of the reflective polarizing plate 14, it penetrates [the same actuation as the above is repeated,] it, and the light which went and came back to the phase contrast plate 16 one time turns into polarization component light which lambda phase shifted further (1/2), and met transparency shaft 14b of the reflective polarizing plate 14. Thus, after the light which penetrated the bottom polarizing plate 5 and carried out incidence to the reflective polarizing plate 14 goes and comes back to the phase contrast plate 16 two times, it penetrates the reflective polarizing plate 14 and it carries out incidence to the bottom polarizing plate 5 of the liquid crystal display component 1 again.

[0008] Thereby, this back light equipment 2 can function as a reflecting plate, and can carry out incidence to the inferior-surface-of-tongue side of the liquid crystal display component 1 again by reflecting the light which carried out incidence from the top-face side of the liquid crystal display component 1 and which carried out outgoing radiation from the inferior-surface-of-tongue side. Thus, with this back light equipment 2, when the tooth-back side of the liquid crystal display component 1 can be illuminated and the light source 18 is made to switch off by making the light source 18 turn on, the function as a reflecting plate for making it display as a liquid crystal display component of a reflective mold also has the liquid crystal display component 1.

[0009]

[Problem(s) to be Solved by the Invention] However, with such back light equipment 2, if 2 ****s of the light which penetrated and carried out incidence of the liquid crystal display component 1 are not carried out within back light equipment 2 as mentioned above when using it as a reflecting plate, incidence cannot be again carried out to the liquid crystal display component 1 side. For this reason, with this back light equipment 2, compared with the case where the transmitted light of the liquid crystal display component 1 is only reflected with a reflecting plate, there is much loss of light, and when displaying in reflective mold mode, there is a problem that the display of the liquid crystal display component 1 becomes dark.

[0010] The technical problem of this invention is offering back light equipment with both the high use effectiveness of light, not only when using it as an original back light, but when using it as a reflecting plate.

[0011]

[Means for Solving the Problem] This invention is back light equipment formed in the tooth-back side of a display device. The reflective polarizing plate which has the transparency shaft which penetrates the light of the polarization component of another side which intersects perpendicularly with the reflective shaft which the tooth back of said display device is met, and while is arranged, and reflects the light of a polarization component, and one [said] polarization component, The reflecting plate arranged at the field side opposite to said display device of this reflective polarizing plate, It is arranged between the light guide section material arranged between said reflective polarizing plates and said reflecting plates, and said reflective polarizing plate and said reflecting plate. The liquid crystal molecular orientation condition of making the transmitted light producing the phase contrast for (1+2n) / 4 (however, positive integer in which n contains 0) wavelength of opposite Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne., and changing a polarization condition, It is characterized by having the liquid crystal cell for polarization conversion switched according to impression of an electrical potential difference in the liquid crystal molecular orientation condition of not producing phase contrast to the transmitted light, and the light source arranged at the end-face side of said light guide section material.

[0012] According to this invention, according to impression of the electrical potential difference of the electrical potential difference (electric field) impressed to the liquid crystal cell for polarization conversion, the liquid crystal cell for polarization conversion can be switched to an operation of lambda (1/4) phase contrast plate and an operation of the translucent part material from which phase contrast does not change. For this reason, by operating the liquid crystal cell for polarization conversion as a lambda (1/4) phase contrast plate, the light from the light source can be introduced into light guide section material, and incidence can be efficiently carried out to the tooth-back side of a display device. Moreover, by operating the liquid crystal cell for polarization conversion as translucent part material which phase contrast does not produce Since it penetrates without producing phase contrast and is reflected with a reflecting plate when the light which penetrated the display device and carried out outgoing radiation to the tooth-back side carries out incidence to the liquid crystal cell for polarization conversion and penetrates, a reflective polarizing plate can be made to be able to penetrate only by gone and coming back to the liquid crystal cell for polarization conversion one time, and incidence can be carried out to the tooth-back side of a display device. Thereby, this back light equipment has the reflex function of a reflection factor high as a reflecting plate of a display device, and uses it for a liquid crystal display component, and compared with the conventional example, there is little loss of light and it can raise the use effectiveness of light.

[0013] In this case, a profit according to claim 2 and said liquid crystal cell for polarization conversion When a liquid crystal molecule is the liquid crystal cell by which homogeneous orientation was carried out, electric field are not impressed and a liquid crystal molecule carries out homogeneous orientation (1/4) When it is used as a lambda phase contrast plate, and an electrical potential difference is impressed, and a liquid crystal molecule carries out orientation almost perpendicularly to the substrate of the pair of the liquid crystal cell for polarization conversion, it can be used as translucent part material which phase contrast does not produce. In this case, as for a profit according to claim 3 and said liquid crystal cell, it is desirable for product deltan-d of refractive-index anisotropy deltan and the cel gap d to be 138**20nm.

[0014] Moreover, a profit according to claim 4 and said liquid crystal cell for polarization conversion When a liquid crystal molecule is the liquid crystal cell by which twist orientation was carried out, electric field are not impressed and a liquid crystal molecule carries out twist orientation When it is used as a phase contrast plate from which phase contrast changes, and electric field are impressed, and a liquid crystal molecule carries out orientation almost perpendicularly to the substrate of the pair of the liquid crystal cell for polarization conversion, it can be used as translucent part material which phase contrast does not produce. In this case, a twist angle is 63.7 degrees and, as for a profit according to claim 5 and said liquid crystal cell, it is desirable for refractive-index anisotropy deltan to be [for the cel gap d] 6500nm in 0.03.

[0015]

[Embodiment of the Invention] Hereafter, with reference to drawing 1 - drawing 4 , 1 operation gestalt of the back light equipment of this invention is explained. In addition, the same sign is attached and explained to the same component as the conventional example shown in drawing 5 - drawing 8 . This back light equipment 20 is replaced with lambda (1/4) phase contrast plate 16 of the conventional example, and has structure which formed the liquid crystal cell 21 for polarization conversion between the light guide section material 15 and a reflecting plate 17.

[0016] As this liquid crystal cell 21 for polarization conversion is shown in drawing 1 , while the transparent electrodes 24 and 25 of an one-sheet plane which consist of ITO etc. throughout the opposed face of the transparent substrates 22 and 23 of a vertical pair are formed Cover these electrodes 24 and 25, the orientation film 26 and 27 is formed, and the substrates 22 and 23 of a pair are joined through the frame-like sealant 28 in the condition of having made these orientation film 26 and 27 countering up and down. Liquid crystal 29 is enclosed in the field enclosed with this sealant 28 and the substrates 22 and 23 of a pair, and the molecule of the liquid crystal 29 of a parenthesis has structure by which homogeneous orientation was carried out.

[0017] Namely, a twist angle is 0 degree and refractive-index anisotropy deltan of liquid crystal 29 of this liquid crystal cell 21 for polarization conversion is 0.021. As product deltan-d of refractive-index anisotropy deltan and the liquid crystal thickness d is set as 138**20nm and it is shown in drawing 2 by 6500nm, the cel gap d, i.e., liquid crystal thickness Orientation processing is made by the orientation film 26 and 27 so that initial orientation may be carried out to direction 29a which a liquid crystal molecule intersects at about 45 degrees to reflective shaft 14a of the reflective polarizing plate 14, and transparency shaft 14b. By this this liquid crystal cell 21 for polarization conversion When an electrical potential difference is not impressed to electrodes 24 and 25, and a liquid crystal molecule carries out homogeneous orientation (1/4) When it has the same function as lambda plate and an electrical potential difference is impressed, by carrying out orientation of the liquid crystal molecule perpendicularly mostly to substrates 22 and 23, the refractive-index anisotropy of a liquid crystal layer is lost mostly, that is, it is set to deltan**0, and it is constituted so that the transmitted light may not be made to produce most phase contrast.

[0018] thus, when a liquid crystal molecule carries out homogeneous orientation, and it has the same function as lambda (1/4) phase contrast plate, when an electrical potential difference is not impressed, and an electrical potential difference is impressed, the liquid crystal cell 21 for polarization conversion Since a liquid crystal molecule carries out orientation perpendicularly mostly to substrates 22 and 23 and phase contrast does not arise, the function of a translucent plate in which phase contrast does not produce this liquid crystal cell 21 for polarization conversion with the function of the phase contrast plate of lambda (1/4) according to un-impressing / impression of an electrical potential difference is switched.

[0019] For this reason, with this back light equipment 20, when turning on the light source 18 and using it as the surface light source, the liquid crystal cell 21 for polarization conversion is operated as the liquid crystal cell 21 for polarization conversion as a lambda (1/4) plate, without impressing an electrical potential difference. Namely, the light will be introduced into the light guide section material 15 if the light source 18 is made to turn on as shown in drawing 3 . The polarization component light which met transparency shaft 14b of the reflective polarizing plate 14 among this introduced light Outgoing radiation is carried out as a polarization component light which penetrated the reflective polarizing plate 14 and met transparency shaft 5a of the bottom polarizing plate 5 towards the tooth back of the liquid crystal display component 1, and also the polarization component light in alignment with reflective shaft 14a is reflected towards the liquid crystal cell 21 for polarization conversion. Since the light from which lambda (1/4) phase shifted, and this phase shifted is reflected with a reflecting plate 17, the liquid crystal cell 21 for polarization conversion is penetrated again and lambda phase shifts further (1/4), when this reflected polarization component light penetrates the liquid crystal cell 21 for polarization conversion, It becomes the polarization component light in alignment with transparency shaft 14b of the reflective polarizing plate 14, and outgoing radiation is carried out as a light which penetrated the reflective polarizing plate 14 and met transparency shaft 5a of the bottom polarizing plate 5 towards the tooth back of the liquid crystal display component 1. For this reason, with this back light equipment 20, like the conventional example, a loss can be suppressed and incidence of the light introduced into light guide section material can be efficiently carried out to the tooth-back side of the liquid crystal display component 1.

[0020] Moreover, when using a back light as a reflecting plate, an electrical potential difference is impressed to the liquid crystal cell 21 for polarization conversion, and the liquid crystal cell 21 for polarization conversion is used as a translucent plate which phase contrast does not produce. That is, as shown in drawing 4 , an extraneous light is incorporated from the top-face side of the liquid crystal display component 1 in the condition of having made the light source 18 switching off. Although the polarization component light in alignment with transparency shaft 4a of the upper polarizing plate 4 of the extraneous lights is incorporated like the conventional example and the liquid crystal cell 3 for a display is penetrated at this time, it becomes the polarization component light to which plane of polarization carried out 90-degree rotation (rotatory polarization), and met transparency shaft 5a of the bottom polarizing plate 5 at this time, the bottom polarizing plate 5 is penetrated, and incidence is carried out to the reflective polarizing plate 14 of back light equipment 20. Since the polarization component light which carried out incidence to this reflective polarizing plate 14 has transparency shaft 14b of the reflective polarizing plate 14 almost parallel to transparency shaft 5a of the bottom polarizing plate 5, as shown in drawing 4 , it penetrates the reflective polarizing plate 14 and the light guide section material 15, and they carry out incidence to the liquid crystal cell 21 for polarization conversion.

[0021] Since the liquid crystal cell 21 for polarization conversion is in the condition that the electrical potential difference was impressed and the liquid crystal molecule carried out orientation in the direction perpendicular to a substrate, at this time, the light which carried out incidence to the liquid crystal cell 21 for polarization conversion Without phase contrast arising, penetrate the liquid crystal cell 21 for polarization conversion, are reflected with a reflecting plate 17, and since this reflected light penetrates the liquid crystal cell 21 for polarization conversion, without phase contrast arising again With the polarization component light which met transparency shaft 14b of the reflective polarizing plate 14 only by going and coming back to the liquid crystal cell 21 for polarization conversion one time, the reflective polarizing plate 14 is penetrated, incidence is carried out to the bottom polarizing plate 5 of a liquid crystal display component 1 tooth-back side, and since this polarization component light is the polarization component light in alignment with transparency shaft 5a, it penetrates the bottom polarizing plate 5. Thus, since 2 ****s of light are not carried out inside like the conventional example even if it uses the back light equipment 20 concerning this invention as a reflecting plate of the liquid crystal display component 1, there can be little loss of light, the use effectiveness of light can be raised, and, thereby, an indication at the time of the reflective mode of the liquid crystal display component 1 can be given bright.

[0022] With the above-mentioned operation gestalt, a twist angle as a liquid crystal cell for polarization conversion in addition, at 0 degree By 0.021, although refractive-index anisotropy deltan of liquid crystal 29 described the case where the liquid crystal cell 21 for polarization conversion whose product deltan-d of refractive-index anisotropy deltan and the cel gap d is 138**20nm in 6500nm was used, the cel gap d For example, not only this but a twist angle may use the liquid crystal cell for polarization conversion whose product deltan-d of refractive-index anisotropy deltan and the cel gap d the cel gap d is 414**20nm in 0.063 for refractive-index anisotropy deltan of liquid crystal by 6500nm at 0 degree. That is, the value of the deltand of the liquid crystal cell for polarization conversion is lambda (1+2n)/4. (however, the positive integer in which n contains 0: 0, 1, 2).

[0023] Moreover, although the above-mentioned operation gestalt described the case where the liquid crystal cell 21 for polarization conversion to which homogeneous orientation of the liquid crystal molecule was carried out was used as a liquid crystal cell for polarization conversion, the liquid crystal cell for polarization conversion to which twist orientation for example, not only of this but the liquid crystal molecule was carried out may be used. Also in this case, when not impressing an electrical potential difference, and a liquid crystal molecule carries out twist orientation, the liquid crystal cell for polarization conversion (1/4) When it has the same function as lambda phase contrast plate and an electrical potential difference is impressed What is necessary is to lose the refractive-index anisotropy of a liquid crystal layer mostly, that is, to be set to deltan**0, and to just be constituted so that the transmitted light may not be made to produce most phase contrast when a liquid crystal molecule carries out orientation perpendicularly mostly to the substrates 22 and 23 of a pair.

[0024] As such a liquid crystal cell for polarization conversion, a twist angle is 63.7 degrees. The cel gap d by 0.03 by 6500nm [refractive-index anisotropy deltan] Although the liquid crystal cell whose product deltan-d of refractive-index anisotropy deltan and the cel gap d is 0.03x6500=195nm is desirable, not only this but a twist angle at 190.1 degrees The cel gap d by 0.09 by 6500nm [refractive-index anisotropy deltan] The liquid crystal cell whose product deltan-d of refractive-index anisotropy deltan and the cel gap d is 0.09x6500=585nm, or a twist angle at 318.2 degrees In 0.15, refractive-index anisotropy deltan may be [the cel gap d] the liquid crystal cell whose product deltan-d of refractive-index anisotropy deltan and the cel gap d is 0.15x6500=975nm at 6500nm.

[0025] In addition, the back light equipment of this invention is widely applicable as back light equipment for various kinds of display devices which needs a predetermined polarization component light not only as the back light equipment for liquid crystal display components but incident light. Moreover, although the liquid crystal cell for polarization conversion is arranged between light guide section material and a reflecting plate with the above-mentioned operation gestalt, not only this but the liquid crystal cell for polarization conversion may be arranged between light guide section material and a reflective polarizing plate, and the same effectiveness as the case of the above-mentioned operation gestalt is done so also in such a case.

[0026]

[Effect of the Invention] As explained above, between the reflecting plates which arrange a reflective polarizing plate to the tooth-back side of a display device, and are arranged in this invention at the tooth-back side of this reflective polarizing plate While have arranged the liquid crystal cell for polarization conversion to which the polarization condition of the transmitted light is changed according to light guide section material and the electrical potential difference impressed and being able to use the liquid crystal cell for polarization conversion as a lambda (1/4) phase contrast plate, it considered as the configuration which can be used also as translucent part material from which phase contrast does not change. Thereby, when using the back light equipment of this invention as a back light of a transparency mold display device, the liquid crystal cell for polarization conversion can be used as a lambda (1/4) phase contrast plate, and the tooth-back side of a display device can be efficiently illuminated like the conventional example, using the light from the light source effectively. Moreover, when using the back light equipment of this invention as a reflecting plate of a reflective mold display device The liquid crystal cell 21 for polarization conversion is used as translucent part material from which phase contrast does not produce the liquid crystal cell for polarization conversion. Without producing phase contrast for the light which penetrated the reflective polarizing plate and carried out incidence to the liquid crystal cell for polarization conversion, the liquid crystal cell for polarization conversion is made to penetrate, it can be made to be able to reflect with a reflecting plate, a reflective polarizing plate can be made to be able to penetrate only by gone and coming back to the liquid crystal cell for polarization conversion one time, and incidence can be carried out to the tooth-back side of a display device. Thereby, even if it uses it as a light reflex means of a display device, compared with the conventional example, there is little loss of light and it can raise the use effectiveness of light.

[0027] In this case, when a liquid crystal molecule is the liquid crystal cell by which homogeneous orientation was carried out, the liquid crystal cell for polarization conversion When not impressing electric field and a liquid crystal molecule carries out homogeneous orientation (1/4) When it is used as a lambda phase contrast plate, and electric field are impressed, and a liquid crystal molecule carries out orientation perpendicularly mostly to the substrate of the pair of the liquid crystal cell for polarization conversion, it can be used as translucent part material which phase contrast does not produce. Moreover, when a liquid crystal molecule is the liquid crystal cell by which twist orientation was carried out, the liquid crystal cell for polarization conversion When not impressing electric field and a liquid crystal molecule carries out twist orientation, it is used as a lambda (1/4) phase contrast plate, and electric field are impressed and a liquid crystal molecule carries out orientation perpendicularly mostly to the substrate of the pair of the liquid crystal cell for polarization conversion It can be used as translucent part material which phase contrast does not produce.

[Brief Description of the Drawings]

[Drawing 1] The sectional view having shown 1 operation gestalt which has arranged the back light equipment of this invention to the inferior-surface-of-tongue side of a liquid crystal display component.

[Drawing 2] Drawing having shown the optical axis of each part material of drawing 1 .

[Drawing 3] Drawing having shown the advance condition of the light when illuminating a liquid crystal display component with the back light equipment of drawing 1 .

[Drawing 4] Drawing having shown the advance condition of the light when using the back light equipment of drawing 1 as a reflecting plate.

[Drawing 5] The sectional view having shown the condition of having arranged conventional back light equipment to the inferior-surface-of-tongue side of a liquid crystal display component.

[Drawing 6] Drawing having shown the optical axis of each part material of drawing 5 .

[Drawing 7] Drawing having shown the advance condition of the light when illuminating a liquid crystal display component with the back light equipment of drawing 5 .

[Drawing 8] Drawing having shown the advance condition of the light when using the back light equipment of drawing 5 as a reflecting plate.

[Description of Notations]
1 Liquid Crystal Display Component
3 Liquid Crystal Cell for Display
4 Upper Polarizing Plate
5 Bottom Polarizing Plate
14 Reflective Polarizing Plate
14a Reflective shaft
14b Transparency shaft
15 Light Guide Section Material
17 Reflecting Plate
18 Light Source
20 Back Light Equipment
21 Liquid Crystal Cell for Polarization Conversion